

Amendments to Claims

1. (Currently Amended) A positive-working photoresist comprising:
 - (A) a branched polymer containing protected acid groups, said polymer comprising one or more branch segment(s) chemically linked along a linear backbone segment, wherein the branch segment(s) contain at least two repeating monomer units and have a number average molecular weight (M_n) of at least 1000; and
 - (B) at least one photoacid generalwherein the photoacid generator is covalently bonded to the branched polymer.
2. (Original) The photoresist of Claim 1 wherein one of the segments contains greater than 50% of the protected acid groups present in the branched polymer.
3. (Original) The photoresist of Claim 2 wherein the branch segment(s) contains greater than 50% of the protected acid groups present in the branched polymer.
4. (Original) The photoresist of Claim 1 wherein the branched polymer contains functional groups that are compatible with the photoacid generator, said functional groups being distributed in the branched polymer such that 25 to 100% of the functional groups are present in the segment of the branched polymer containing a majority of the protected acid groups.
5. (Canceled)
6. (Currently Amended) The photoresist of Claim 5 1 wherein the photoacid generator is covalently bonded to the branch segment(s).
7. (Original) The photoresist of Claim 6 wherein one of the segments contains greater than 50% of the protected acid groups present in the branched polymer.
8. (Original) The photoresist of Claim 7 wherein the branch segment(s) contain greater than 50% of the protected acid groups present in the branched polymer.
9. (Original) The photoresist of Claim 1 wherein the branched polymer is comprised of an acrylate polymer, a methacrylate polymer, an acrylate/methacrylate copolymer, and combinations thereof.
10. (Original) The photoresist of Claim 1 further comprising a solvent.
11. (Original) The photoresist of Claim 1 wherein the branched polymer is formed by addition polymerization of at least one ethylenically unsaturated macromer component and at least one ethylenically unsaturated comonomer.
12. (Original) The photoresist of Claim 1 wherein the branched polymer segment is attached to a preformed linear backbone by chemical reaction.
13. (Previously Presented) The photoresist of Claim 1 wherein
 - (a) the ethylenically unsaturated macromer component has a number average molecular weight (M_n) in the range of 1000 to 15,000;

(b) the linear backbone segment has a number average molecular weight (M_n) between about 2,000 and about 500,000; and

(c) the weight ratio of the linear backbone segment to the branch segment(s) is within a range of about 50/1 to about 1/10.

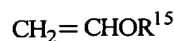
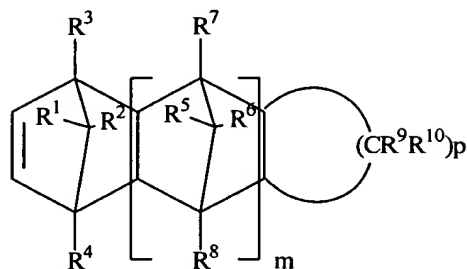
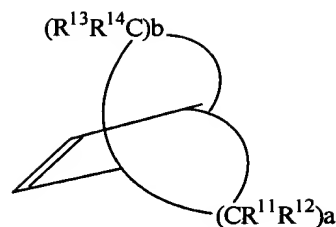
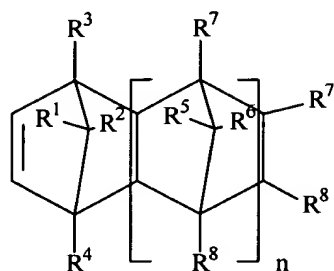
14. (Original) The photoresist of Claim 1 wherein the branched polymer has a glass transition temperature of at least 22°C.

15. (Original) The photoresist of Claim 1 further comprising a dissolution inhibitor.

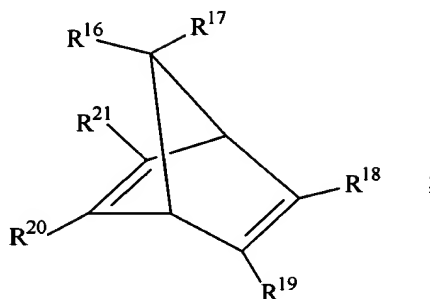
16. (Previously Presented) The photoresist of Claim 1 wherein the branched polymer is an acrylic/methacrylic/styrenic copolymer being at least 60% by weight acrylate and having at least 60% methacrylate repeat unit content present in the copolymer in a first location, the first location being one of the segments, the second location being a segment different from the first location, wherein at least 60% of the acrylate repeat unit content in the copolymer is present in the second location.

17. (Previously Presented) The photoresist of Claim 1 wherein the branched polymer is a fluorine-containing copolymer comprising a repeat unit derived from at least one ethylenically unsaturated compound containing at least one fluorine atom covalently attached to an ethylenically unsaturated carbon atom.

18. (Original) The photoresist of Claim 17 wherein the fluorine-containing copolymer is further comprised of a repeat unit derived from at least one unsaturated compound selected from the group consisting of:



and



wherein:

each of m and n is 0, 1 or 2, p is an integer of at least 3;

a and b are independently 1 to 3 except that a is not = 1 when b = 2 or vice

versa;

R¹ to R¹⁴ are the same or different and each represents a hydrogen atom, a halogen atom, a carboxyl group, a C₁ to C₁₄ secondary or tertiary alkyl carboxylate, a hydrocarbon group or a substituted hydrocarbon group;

R¹⁵ is a saturated alkyl group of about 4 to 20 carbon atoms, optionally containing one or more ether oxygens with the proviso that the ratio of carbon atoms to hydrogen atoms is greater than or equal to 0.58; and

R¹⁶ to R²¹ are each independently hydrogen atoms, C₁ to C₁₂ alkyls, (CH₂)_qCO₂A, CO₂(CH₂)_qCO₂A or CO₂A wherein q is 1 to 12 and A is hydrogen or an acid protecting group with the proviso that at least one of R¹⁸ to R²¹ is CO₂A.

19. (Original) The photoresist of Claim 18 wherein the fluorine-containing copolymer further comprises a repeat unit derived from at least one ethylenically unsaturated compound containing a fluoroalcohol functional group having the structure:



wherein R_f and R_f' are the same or different fluoroalkyl groups of from 1 to about 10 carbon atoms or taken together are $(CF_2)_n$ wherein n is 2 to 10.

20. (Original) The photoresist of Claim 17 wherein the fluorine-containing copolymer further comprises a repeat unit derived from at least one ethylenically unsaturated compound containing a fluoroalcohol functional group having the structure:



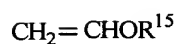
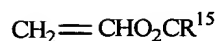
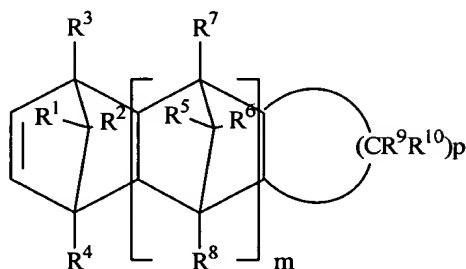
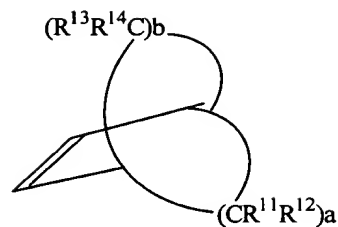
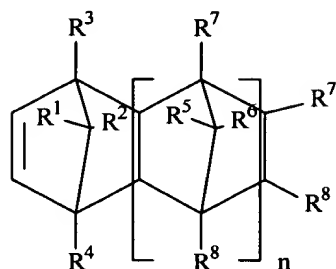
wherein R_f and R_f' are the same or different fluoroalkyl groups of from 1 to about 10 carbon atoms or taken together are $(CF_2)_n$ wherein n is 2 to 10.

21. (Original) The photoresist of Claim 1 wherein the branched polymer is a fluorine-containing copolymer comprising a repeat unit derived from at least one ethylenically unsaturated compound containing a fluoroalcohol functional group having the structure:

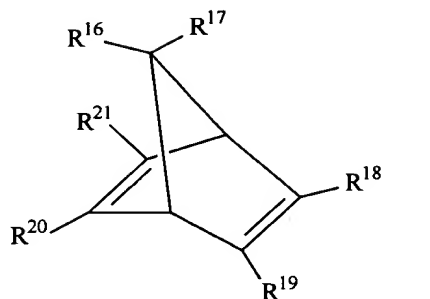


wherein R_f and R_f' are the same or different fluoroalkyl groups of from 1 to about 10 carbon atoms or taken together are $(CF_2)_n$ wherein n is 2 to 10.

22. (Original) The photoresist of Claim 21 wherein the fluorine-containing copolymer is further comprised of a repeat unit derived from at least one unsaturated compound selected from the group consisting of:



and



wherein:

each of m and n is 0, 1 or 2, p is an integer of at least 3;

a and b are independently 1 to 3 except that a is not = 1 when b = 2 or vice versa;

R¹ to R¹⁴ are the same or different and each represents a hydrogen atom, a halogen atom, a carboxyl group, a C₁ to C₁₄ secondary or tertiary alkyl carboxylate, a hydrocarbon group or a substituted hydrocarbon group;

R¹⁵ is a saturated alkyl group of about 4 to 20 carbon atoms, optionally containing one or more ether oxygens with the proviso that the ratio of carbon atoms to hydrogen atoms is greater than or equal to 0.58; and

R¹⁶ to R²¹ are each independently hydrogen atoms, C₁ to C₁₂ alkyls, (CH₂)_qCO₂A, CO₂(CH₂)_qCO₂A or CO₂A wherein q is 1 to 12 and A is hydrogen or an acid protecting group with the proviso that at least one of R¹⁸ to R²¹ is CO₂A.

23. (Original) The photoresist of Claim 21 wherein the photoacid generator is covalently bonded to the branched polymer.

24. (Original) The photoresist of Claim 23 wherein the photoacid generator is covalently bonded to the branch segment(s).

25. (Original) The photoresist of Claim 24 wherein one of the segments contains greater than 50% of the protected acid groups present in the branched polymer.

26. (Original) The photoresist of Claim 25 wherein the branch segment(s) contain greater than 50% of the protected acid groups present in the branched polymer.

27. (Previously Presented) A process for preparing a photoresist image on a substrate comprising, in order:

(W) applying a photoresist composition on a substrate, wherein the photoresist composition comprises:

(a) a branched polymer containing protected acid groups, said polymer comprising one or more branch segment(s) chemically linked along a linear backbone segment, wherein the branched polymer contains sufficient functionality to render the photoresist developable to afford a relief image, upon imagewise exposure to radiation selected from the group consisting of ultraviolet and violet and subsequent heating, wherein the branch segment(s) contain at least two repeating monomer units and have a number average molecular weight (Mn) of at least 1000;

(b) at least one photoacid generator; and

(c) a solvent;

(X) drying the coated photoresist composition to remove solvent and thereby to form a photoresist layer on the substrate;

(Y) imagewise exposing the photoresist layer to form imaged and non-imaged areas; and

(Z) developing the exposed photoresist layer having imaged and non-imaged areas to form the relief image on the substrate.

28. (Original) The process of Claim 27 further comprising a step of heating the photoresist layer following step (X) and prior to step (Z).

29. (Original) The process of Claim 27 wherein the photoresist layer is developed with an aqueous alkaline developer.

30. (Previously Presented) The photoresist of Claim 10 wherein the solvent is selected from the group consisting of cyclohexanone, 2-butanone, propylene glycol methyl ether acetate, and methyl isobutyl ketone.

31. (Previously Presented) The photoresist of Claim 10 wherein the solvent is selected from the group consisting of (i) 2-butanone and propylene glycol methyl ether acetate in combination, (ii) methyl isobutyl ketone and propylene glycol methyl ether acetate in combination, and (iii) cyclohexanone and propylene glycol methyl ether acetate in combination.

32. (Previously Presented) The process of Claim 27 wherein the solvent is selected from the group consisting of cyclohexanone, 2-butanone, propylene glycol methyl ether acetate, and methyl isobutyl ketone.

33. (Previously Presented) The process of Claim 27 wherein the solvent is selected from the group consisting of (i) 2-butanone and propylene glycol methyl ether acetate in combination, (ii) methyl isobutyl ketone and propylene glycol methyl ether acetate in combination, and (iii) cyclohexanone and propylene glycol methyl ether acetate in combination.

34. (Previously Presented) The photoresist of Claim 1 wherein the branched polymer is an acrylic/methacrylic copolymer being at least 60% by weight acrylate and having at least 60% of methacrylate repeat unit present in a first location, the first locating being one of the segments, the second locating being a segment different from the first location, wherein at least 60% of the acrylate repeat unit content in the copolymer is present in the second location.